

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 1/25/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 1/25/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

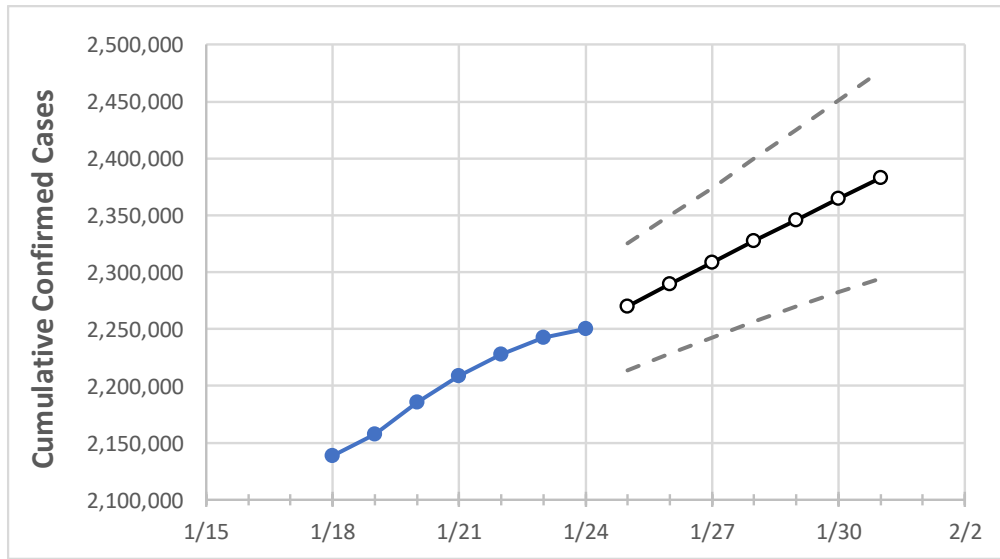
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Texas State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Texas	2,208,871	2,227,789	2,242,473	2,250,421	2,270,054	2,289,397	2,308,378	2,327,245	2,345,892	2,364,505	2,382,698

Note: The State’s projection shows a “best estimate” curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Bexar	155,588	157,835	159,519	160,026	162,026	163,958	165,913	167,894	169,923	171,917	173,924
Brazoria	26,750	27,130	27,300	27,581	27,853	28,126	28,403	28,681	28,953	29,231	29,514
Brazos	17,371	17,490	17,650	17,780	17,925	18,069	18,210	18,354	18,495	18,638	18,777
Collin	66,040	66,967	67,863	68,108	68,883	69,632	70,377	71,092	71,808	72,529	73,245
Dallas	241,661	243,726	245,646	246,820	248,716	250,551	252,440	254,258	256,101	257,951	259,740
Denton	48,945	49,600	49,816	49,816	50,345	50,888	51,443	52,000	52,582	53,179	53,764
El Paso	108,835	109,108	109,589	110,125	110,635	111,147	111,662	112,185	112,708	113,228	113,775
Ellis	17,297	17,459	17,597	17,597	17,769	17,939	18,106	18,271	18,432	18,589	18,748
Fort Bend	46,639	47,021	47,021	47,021	47,697	48,347	49,022	49,725	50,493	51,276	51,984
Galveston	27,834	28,296	28,624	28,878	29,253	29,631	30,014	30,401	30,796	31,186	31,597
Harris	293,271	294,266	296,521	297,629	299,984	302,369	304,771	307,227	309,676	312,102	314,525
Hidalgo	59,504	60,213	60,213	60,213	60,744	61,316	61,919	62,527	63,156	63,797	64,440
Johnson	15,235	15,446	15,615	15,615	15,805	16,000	16,199	16,399	16,606	16,807	17,007
Lubbock	45,876	45,994	46,104	46,163	46,269	46,369	46,466	46,557	46,645	46,731	46,813
McLennan	22,373	22,506	22,587	22,657	22,782	22,903	23,026	23,145	23,260	23,376	23,487
Montgomery	35,171	35,480	35,480	35,480	35,890	36,301	36,707	37,115	37,528	37,932	38,353
Tarrant	201,310	203,174	204,252	205,329	207,360	209,354	211,358	213,298	215,263	217,248	219,284
Travis	63,751	64,291	64,658	64,963	65,619	66,263	66,917	67,551	68,227	68,877	69,545
Williamson	32,571	32,949	32,949	32,949	33,462	33,975	34,501	35,032	35,570	36,130	36,675

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- **Beds:** For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report ([MMWR, March 18, 2020](#)) and state reports of COVID-19 cases.
- **ICU:** The CDC report found that 24% of hospitalized cases require ICU care.
- **Ventilators:** Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.

Texas Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	1/21	1/22	1/23	1/24	1/26		1/28		1/30							
Bexar	155,588	157,835	159,519	160,026	163,958	(32,792)	[7,870]	{3,935}	167,894	(33,579)	[8,059]	{4,029}	171,917	(34,383)	[8,252]	{4,126}
Brazoria	26,750	27,130	27,300	27,581	28,126	(5,625)	[1,350]	{675}	28,681	(5,736)	[1,377]	{688}	29,231	(5,846)	[1,403]	{702}
Brazos	17,371	17,490	17,650	17,780	18,069	(3,614)	[867]	{434}	18,354	(3,671)	[881]	{440}	18,638	(3,728)	[895]	{447}
Collin	66,040	66,967	67,863	68,108	69,632	(13,926)	[3,342]	{1,671}	71,092	(14,218)	[3,412]	{1,706}	72,529	(14,506)	[3,481]	{1,741}
Dallas	241,661	243,726	245,646	246,820	250,551	(50,110)	[12,026]	{6,013}	254,258	(50,852)	[12,204]	{6,102}	257,951	(51,590)	[12,382]	{6,191}
Denton	48,945	49,600	49,816	49,816	50,888	(10,178)	[2,443]	{1,221}	52,000	(10,400)	[2,496]	{1,248}	53,179	(10,636)	[2,553]	{1,276}
El Paso	108,835	109,108	109,589	110,125	111,147	(22,229)	[5,335]	{2,668}	112,185	(22,437)	[5,385]	{2,692}	113,228	(22,646)	[5,435]	{2,717}
Ellis	17,297	17,459	17,597	17,597	17,939	(3,588)	[861]	{431}	18,271	(3,654)	[877]	{439}	18,589	(3,718)	[892]	{446}
Fort Bend	46,639	47,021	47,021	47,021	48,347	(9,669)	[2,321]	{1,160}	49,725	(9,945)	[2,387]	{1,193}	51,276	(10,255)	[2,461]	{1,231}
Galveston	27,834	28,296	28,624	28,878	29,631	(5,926)	[1,422]	{711}	30,401	(6,080)	[1,459]	{730}	31,186	(6,237)	[1,497]	{748}
Harris	293,271	294,266	296,521	297,629	302,369	(60,474)	[14,514]	{7,257}	307,227	(61,445)	[14,747]	{7,373}	312,102	(62,420)	[14,981]	{7,490}
Hidalgo	59,504	60,213	60,213	60,213	61,316	(12,263)	[2,943]	{1,472}	62,527	(12,505)	[3,001]	{1,501}	63,797	(12,759)	[3,062]	{1,531}
Johnson	15,235	15,446	15,615	15,615	16,000	(3,200)	[768]	{384}	16,399	(3,280)	[787]	{394}	16,807	(3,361)	[807]	{403}
Lubbock	45,876	45,994	46,104	46,163	46,369	(9,274)	[2,226]	{1,113}	46,557	(9,311)	[2,235]	{1,117}	46,731	(9,346)	[2,243]	{1,122}
McLennan	22,373	22,506	22,587	22,657	22,903	(4,581)	[1,099]	{550}	23,145	(4,629)	[1,111]	{555}	23,376	(4,675)	[1,122]	{561}
Montgomery	35,171	35,480	35,480	35,480	36,301	(7,260)	[1,742]	{871}	37,115	(7,423)	[1,782]	{891}	37,932	(7,586)	[1,821]	{910}
Tarrant	201,310	203,174	204,252	205,329	209,354	(41,871)	[10,049]	{5,025}	213,298	(42,660)	[10,238]	{5,119}	217,248	(43,450)	[10,428]	{5,214}
Travis	63,751	64,291	64,658	64,963	66,263	(13,253)	[3,181]	{1,590}	67,551	(13,510)	[3,242]	{1,621}	68,877	(13,775)	[3,306]	{1,653}
Williamson	32,571	32,949	32,949	32,949	33,975	(6,795)	[1,631]	{815}	35,032	(7,006)	[1,682]	{841}	36,130	(7,226)	[1,734]	{867}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.